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U.S. WATER CONSERVATION LABORATORY

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INTRODUCTION

The U.S. Water Conservation Laboratory is part of the Agricultural Research Service (ARS) which is the major research arm of the U.S. Department of Agriculture. The primary mission of ARS is to help meet the food and fiber needs of our Nation. ARS works in close cooperation with State experiment stations, State departments of agriculture, other government agencies, public organizations, farmers, ranchers, and industry.

The Agency's research is conducted at 155 laboratories, field stations, and work sites in 46 States, the District of Columbia, Puerto Rico, the Virgin Islands, and nine foreign countries. In the United States, ARS facilities are located in four locally administered geographical regions. Twelve Western States comprise the Western Region with headquarters at Berkeley, California. The Western Region is further divided into six Areas. Arizona and New Mexico, with headquarters at Tucson, comprise our Area. Research projects are located at Phoenix, Tucson, and Flagstaff, Arizona, and Las Cruces, New Mexico.

The organizational structure of ARS is designed to insure active research programs and to provide maximum responsiveness to the needs and problems of the people.

HISTORY AND MISSION

The U.S. Water Conservation Laboratory was built on five acres of land donated by the University of Arizona and was dedicated on October 19 1959. The Laboratory is one of the few ARS facilities wholly devoted to water research. The studies are aimed at finding better ways to increase water supplies, to use water more efficiently, and to reduce water losses in soil-plant-atmosphere systems. The research is national in scope and deals with both present and potential problems. Though the results of the research are primarily documented in technical literature, the information is available to everyone.

The Laboratory is well equipped for the application of both theoretical and practical research. Equipment ranges from electronic data acquisition and processing systems and atomic adsorption and infrared spectral analyzers to ordinary surveyors' levels and hand-powered soil augers. Research is conducted at field sites as well as in the Laboratory.

The research teams are composed of engineers, soil scientists, plant physiologists, physicists, chemists, microbiologists, and hydrologists. A computer programmer, technicians, assistants, machinists, administrators, secretaries, clerks, and maintenance workers round out the personnel. The research is concentrated in four areas: soil, plant, and atmosphere systems; irrigation and hydraulics; water harvesting and hydrology; and subsurface water management.

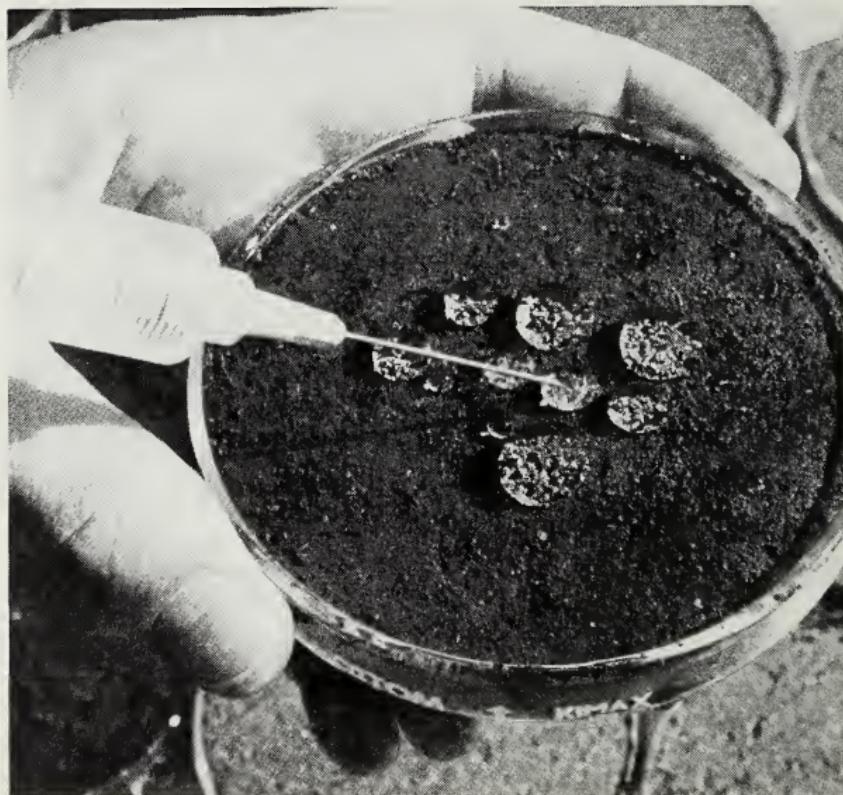
WATER HARVESTING AND HYDROLOGY

K. R. Cooley, Research Leader

Water harvesting research is concentrated on improving ways of collecting natural precipitation to increase usable water supplies, particularly for remote homesites, livestock, and wildlife.

Presently, all but very small amounts of precipitation are lost, but the researchers here are finding ways to increase water runoff and to store it for later beneficial use. Some of the water-harvesting treatments under study include smoothing and compacting soil; clearing or altering vegetation; waterproofing soils with waxes, salts, or silicones; and covering soils with rubber or plastic sheeting, asphalt-fiberglass, sheet metal, or concrete.

Complete water harvesting systems also include facilities for storing collected water. Accordingly, the researchers are looking for ways to minimize both seepage and evaporation losses from the systems. A computer model has been developed that yields the optimum size of catchment and storage facility in relation to rainfall patterns and demand for harvested water.



Laboratory testing of materials that make soil water repellent for water harvesting systems.

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Wax-treated catchment and steel storage tank in northwestern Arizona enable cattle to forage where lack of water prevented grazing before.

IRRIGATION AND HYDRAULICS

J. A. Replogle, Research Leader

Irrigation research focuses on drip and surface irrigation methods. For the drip method, our studies concern improved system design, better management, and avoidance of emitter plugging. For surface irrigation, our research involves development of (1) automatic irrigation systems capable of applying the correct amount of water to several fields in sequence with little or no manual labor; (2) techniques for high-rate flooding of level basins to increase uniformity of irrigation; (3) high-flow-rate irrigation structures that minimize field erosion; and (4) improved application techniques for conventional graded border and furrow irrigation systems. Studies applicable to all irrigation methods include determining water needs of crops and seasonal use patterns, and developing practical and accurate water measurement devices and techniques for field deliveries of water.



Automatic irrigation of dead-level fields with piston-operated jack gates that are opened in sequence from a central control unit.

SOIL-PLANT-ATMOSPHERE SYSTEMS

R. D. Jackson, Research Leader

Research is underway to develop new or improved techniques for assessing soil moisture content and plant health from measurements of the temperature of soil surfaces or crop canopies. These measurements are made remotely using hand-held infrared radiation thermometers and airplane-mounted infrared scanners. In the future, measurements will be made from satellites. Successful completion of these studies will help improve crop yield predictions, enable better scheduling of irrigations, assist in predicting potential insect invasions, measure incidence and spread of crop diseases, and provide data for improved dry-land farming and range management.

Other studies are aimed at improving the effectiveness of controlled environmental systems in the ARS-developed low-energy greenhouse. This greenhouse can be sealed to retain carbon dioxide-enriched air for increased crop production while maintaining suitable temperatures for growing plants.

The researchers also are seeking ways to reduce unnecessary water losses by identifying the key environmental factors affecting water movement in crops and soils that can be altered by management practices. One objective is to identify crops that have a high yield per unit of water used.



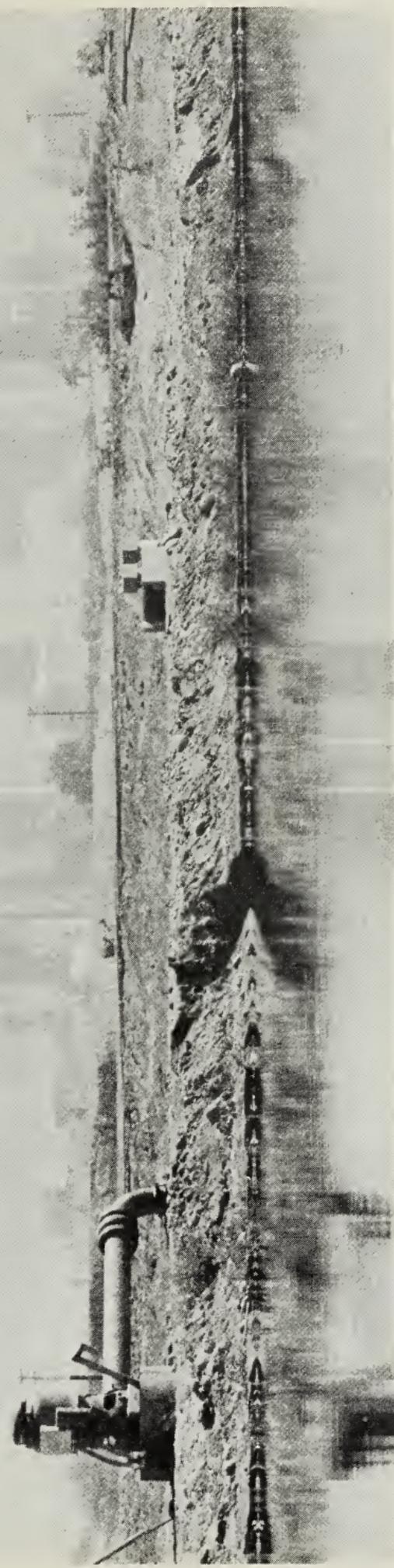
Measuring the temperature of a cotton crop with an infrared radiation thermometer.

SUBSURFACE WATER MANAGEMENT

*H. Bouwer, Research Leader and
Laboratory Director*

The work primarily consists of developing design and operational criteria for rapid-infiltration systems to renovate sewage effluent by groundwater recharge. The Flushing Meadows project is an example of these studies where sewage effluent from Phoenix, after primary and secondary treatment, is pumped into experimental infiltration basins in the Salt River bed west of 91st Avenue. Impurities are removed as the water seeps and percolates to the groundwater below. The renovated water can be pumped from wells and used for unrestricted irrigation, recreational lakes, and industrial purposes. The low cost of sewage effluent renovation with this system establishes sewage as a valuable water resource in water-short areas. The research is being expanded to a 40-acre operational infiltration system installed by the City of Phoenix near 35th Avenue and Salt River to renovate secondary sewage effluent for unrestricted irrigation.

The researchers also conduct studies on predicting effects of irrigated agriculture on groundwater and vice versa. This research includes measuring seepage from canals, predicting amounts and quality of deep-percolation water that moves into groundwater below irrigated fields, and determining how much water can be saved by controlling salt cedar and other plants in floodplains with no immediate agricultural value.



Infiltration basin receiving sewage effluent from Phoenix and well pumping renovated sewage water for unrestricted irrigation.

Visitors are welcome at the U.S. Water Conservation Laboratory. To make tour arrangements or to obtain information regarding agricultural research at this facility, contact the following by mail or telephone:

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